An Integrated Framework for IT Infrastructure Management by Work Flow Management using Hierarchical Tree Structure

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Abstract. *Information Technology (IT)* is one of the most emerging fields in today's Internet world. IT can be defined in various ways, but is broadly considered to encompass the use of computers and telecommunications equipment to store, retrieve, transmit and manipulate data. Infrastructure is the base for everything. IT also has an infrastructure, which can be managed and maintained properly. For an organization's Information Technology, Infrastructure Management (IM) is the management of essential operation components, such as policies, processes, equipment, data, human resources and external contacts, for overall effectiveness.

In this paper, we propose a methodology to manage the IT Infrastructure in a better way. Our methodology uses the tree-structure based architecture to manage the infrastructure with less manual power. The process of how to manage the infrastructure is discussed with efficient methodology and necessary steps with algorithm, in this paper. Also, in this paper, the process of workflow management on IT infrastructure management has been provided.

Keywords: Information Technology, Infrastructure Management, Manual Power, Tree-Structure.

I. Introduction

Information Technology (IT) is defined as "maintaining and managing the computer-based information systems by implementing the design in an application". The importance to the infrastructure management has been varying continuously since the late 1980's. One third of IT spend is mainly for management and support of technology infrastructure. Organizations focused on reducing IT spending mainly for on-going management and support are required to decouple the user and administrative functions. Infrastructure Management Services offers services across the entire network life cycle and we use best shoring approach to deliver these services as shown in Fig. 1.

A. Challenges Faced in Infrastructure Management Services (IMS)

- Large spend on IT Management and support without clear insight on returns from the costs incurred.
- Lack of flexibility in some parts of IT Infrastructure due to legacy or new technologies.
- Significant time and amount spent to acquire or retain critical IT Staff.

Among other purposes, infrastructure management seeks to:

Fig.1 IT Management Services

- Reduce duplication of effort.
- Ensure adherence to standards
- Enhance the flow of information throughout an information system.
- Promote adaptability necessary for a changeable environment.
- Ensure interoperability among organizational and external entities.
- Maintain effective change management policies and practices.

B. IT Infrastructure Management Process

In IT, the members in an organization develops the product based on the requirements submitted to them. After the product in development phase, then it moves on to maintenance phase. The Maintenance phase consists of support team with several team members. The support team maintains the product by taking the complaints or queries raised by the user or customer. Some of the common queries are data missing, database access prohibition, database updating and so on. These queries can be monitored by the support team and proper solution has been provided to them. The user request can be solved by taking following activities to manage the IT Infrastructure. The user who wants to request for service can send the **Service Request** (SR). The service request can also be termed as Ticket. Upon receiving

DOI: 03.LSCS.2013.1.574

the ticket, the user is provided with **Service Request Number**. All the tickets raised by the user, can be solved by the **Support Team**. The tickets are saved in the queue of the support team. The members of the support team process the Service Request by fetching the request from the queue and then they solve the problem and the solution is termed as **Resolution.** The user can view the status of the request that they raised. The status may be of New, Assigned to, WIP (Work-In Progress), and Closed.

The summary of the ITIM services is discussed below:

- User creates the ticket. (*Status = New*)
- Support Team Leader opens the ticket and assigned to the member who is better to solve the ticket. (*Status = Assigned to <member>)*
- The allocated member process the request. (*Status = WIP*)
- The support team leader specifies SLA, the time limit to close the ticket. (*Status = Closed*)

In this ITIM services, there may be difficulty of finding the best member to solve the ticket, when more number of tickets available in the queue and also to search whether the member has no allocated jobs and so on. These are all done manually which may be time consuming and a tedious process. In this paper, this can be automated and all the things have been carried out automatically which will reduce the manual work and also time consumption.

II. Related Work

In paper [1], Girish et al described Support analytics (i.e., statistical analysis, modeling and mining of customer/ operations support tickets data) was important in service industries. In this paper, they adopt a domain-driven data mining approach to support analytics with a focus on IT infrastructure Support (ITIS) services. In paper [2], ERIK et al conveyed the results from case-based research into three firms. Firms seeking to offshore infrastructure management need to develop effective risk mitigation strategies for selecting service providers. Therefore it will become increasingly necessary for Service Providers to develop offshore outsourcing capabilities.

In paper [3], Borjo et al presented OpenNebula, an open source virtual infrastructure manager that can be used to deploy virtualized services on both a local pool of resources and on external IaaS clouds, and Haizea, a resource lease manager that can act as a scheduling backend for OpenNebula providing features not found in other cloud software or virtualization-based datacenter management software, such as advance reservations and resource preemption, which they argue to be specially relevant for private and hybrid clouds.

In paper [4], Amit et al provided a high-level overview of the current workflow management methodologies and software products. In addition, they discuss the infrastructure technologies that can address the limitations of current commercial workflow technology and extend the scope and mission of workflow management systems. In particular, they discuss how distributed object management and customized transaction management can support further advances in the commercial state of the art in this area.

In paper [5], Jie et al described the goal of an effective course management system for assisting course managers to make informed decisions about what materials should be most appropriate to be presented to students (learners) and what learning strategies or methods should be used for the students. The system was supported by the design of a novel framework for user-driven data analytics in the cloud. Different modules of the framework will be illustrated in detail in the context of course management.

In paper [6], Mahmoud presented an integrated component-based framework that would enable the implementation of knowledge-intensive GIS-based infrastructure management systems. The framework defines four-tier architecture: the GIS interface tier, the applications tier, the infrastructure management components tier, and the data/knowledge repository tierThe data/knowledge repository tier maintains a store for infrastructure data and a knowledge base where infrastructure management knowledge can be captured, represented, shared, and reused. Several issues related to information modeling and integration was discussed. A prototype that supports management of sanitary and storm water sewer systems was also presented.

In paper [7], Pablo presented an integrated framework to address performance prediction and maintenance optimization for transportation infrastructure facilities. The framework was based on formulating the underlying resource allocation problem as discrete- time, stochastic optimal control problem with linear dynamics and a quadratic criterion. To illustrate the advantages of the proposed approach, they conduct a numerical study where they examine the case of multiple technologies being used simultaneously to collect condition data.

In paper [8] [9], Keahey stated about the projects like Globus Nimbus [8] (http://workspace.globus.org/) and Eucalyptus [9] (http: //www.eucalyptus.com/), which they term cloud toolkits, can be used to transform existing infrastructure into an IaaS cloud with cloud-like interfaces. Eucalyptus was compatible with Amazon's EC2 interface and was designed to support additional client-side interfaces. Globus Nimbus exposes EC2 and WSRF interfaces and offers self-configuring virtual cluster support. In paper [10], Medina-Mora et al. categorize processes in an organization into material processes, information processes, and business processes. The scope of a *material process* was to assemble physical components and deliver physical products.

III. Proposed Integrated Framework for IT Infrastructure Management

The aim of the paper is to develop a framework to automate the workflow in the IT field by processing the user request and to manage the IT Infrastructure.

The summary of the paper is as follows: The IT organization consists of different areas and each area is filled with several resource persons. When the user submits the

DOI: 03.LSCS.2013.1.574

request, it will be processed by one of the resource person. In this proposed method, to automate the process of allocating the resource person to solve the problem submitted by the user, we have to follow the steps given below:

First, each organization is represented with tree-based structure, in which the detail about the resource person is organized. The details includes, the name of the resource person, their specialization, the area to be deal by the resource person, what kind of problem can be solved by the person and so on. The sample tree-based structure for representing an organization is given in Fig. 2.

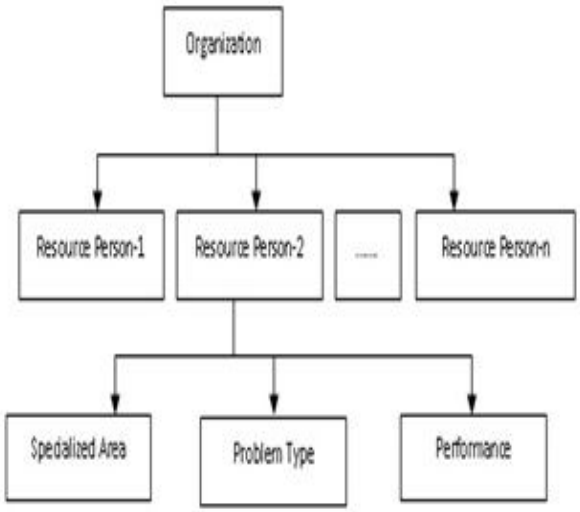

Fig.2 Tree Structure Representing an Organization

When the user enters into the site, the user request called Service Request (Ticket) has been taken and stored in the queue of the Support Team. Upon receiving the ticket, based on the concern, the ticket is classified into category and sub-category. Based on the classified category and sub-category, the resource list on that category are noted and from the list, the best performed resource person is identified automatically based on the tree-structure. After choosing the resource person, the ticket is assigned to that resource person and the status of the ticket is set to "Assigned to resource". The status of the ticket is updated automatically as the ticket being processed. Thus, by assigning the ticket to the best resource person on the same category, the user gets the response within the specified SLA. Thus, the process is being automated to get the better performance and the IT infrastructure can be managed successfully.

IV. Framework Application

The proposed methodology can be applied on any area to get the better result. In this paper, we take the banking application. The banking can be organized in a tree-structure as as shown in Fig. 3.

If the user request for amount transfer failure then based on the tree-structure, the request is assigned to the resource person in that branch. Thus the request has been processed and the resolution has been provided to the user.

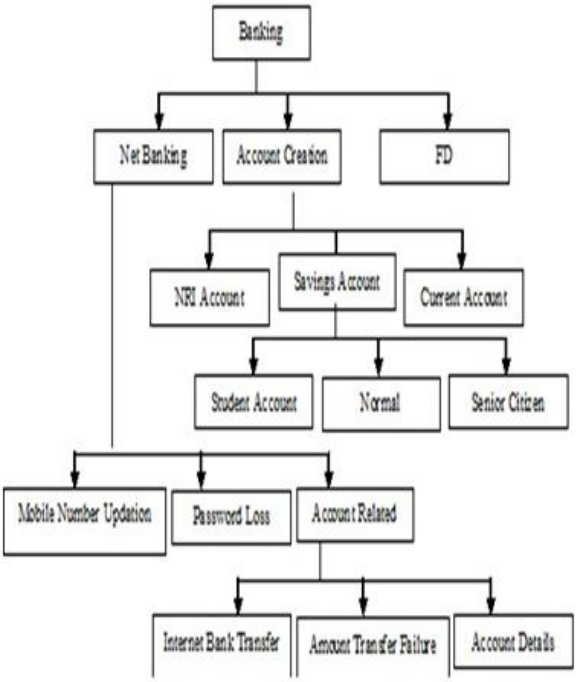

Fig.3 Tree Structure Representing Banking

V. Implementation Algorithm

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Start
Categorize the Resource Person, rlist
Get the Service Request, req
Categorize the req, sr
For i=0 to rlist.count-1
If rlist(i) = sr then
Resource = rlist(i)
End if
Next
For j=0 to rlist(i).count-1
If Performance(rlist(i)) = "Better" then
Rp = rlist(i)
End if
Next
Allocate the ticket, req to resource person Rp.
End
```

Conclusion

Thus this paper provides the framework to manage the IT Infrastructure by organizing in a tree-like structure to assign the service request to the resource person. In this scenario, the workload can also be managed and the process of assigning the ticket to the resource person is also automated such that the manual effort is reduced. As already mentioned, one-third of the IT spend in the management of infrastructure. By implementing this methodology will reduce the expense and also it yield better performance. Organizing in a tree-based structure will helps to fetch the information much faster and easier.

DOI: 03.LSCS.2013.1.574

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DOI: 03.LSCS.2013.1.574